

HYDROGEN FLUORIDE

Hydrogen fluoride is a federal hazardous air pollutant and was identified as a toxic air contaminant in April 1993 under AB 2728.

CAS Registry Number: 7664-39-3

HF

Molecular Formula: HF

Hydrogen fluoride is a colorless, fuming liquid or gas with a strong, irritating odor. It is soluble in water, alcohol, and in many organic solvents. Hydrogen fluoride is corrosive and is incompatible with metals, concrete, glass, and ceramics (Sittig, 1985).

Physical Properties of Hydrogen Fluoride

Synonyms: hydrofluoric acid; fluohydric acid

Molecular Weight:	20.01
Boiling Point:	19.51 °C
Melting Point:	-83.55 °C
Vapor Density:	1.27 at 34 °C (air = 1)
Density/Specific Gravity:	0.699 at 22 °C (water = 1)
Vapor Pressure:	400 mm Hg at 2.5 °C
Conversion Factor:	1 ppm = 0.82 mg/m ³

(HSDB, 1991; U.S. EPA, 1994a)

SOURCES AND EMISSIONS

A. Sources

Hydrogen fluoride is used to clean cast iron, copper, and brass; for removing efflorescence from brick and stone, and sand particles from metallic castings; for frosting and etching glass and enamel; polishing crystal glass; decomposing cellulose; enameling and galvanizing iron; and, increasing porosity of ceramics. It is also used in fluorination processes, the manufacture of fluorides, the separation of uranium isotopes, making fluoride-containing plastics, as a gasoline alkylation catalyst, specialty metal manufacture, as a chemical intermediate, in laundry mixtures in place of oxalic acid, in oil well acidizing, froth flotation of ores, and in clouding electric bulbs. Its salts are used to arrest undesirable fermentation in brewing (HSDB, 1991). Fluoride has been detected in cigarette smoke, drinking water, and food (U.S. EPA, 1994a).

The primary stationary sources that have reported emissions of hydrogen fluoride in California

are manufacturers of aircraft and parts, manufacturers of agricultural chemicals, and petroleum refining (ARB, 1997b).

B. Emissions

The total emissions of hydrogen fluoride from stationary sources in California are estimated to be at least 70,000 pounds per year, based on data reported under the Air Toxics “Hot Spots” Program (AB 2588) (ARB, 1997b).

C. Natural Occurrence

No information about the natural occurrence of hydrogen fluoride was found in the readily-available literature.

AMBIENT CONCENTRATIONS

No Air Resources Board data exist for ambient measurements of hydrogen fluoride. However, the United States Environmental Protection Agency (U.S. EPA) has compiled ambient air data for hydrogen fluoride from several locations throughout the United States for 1985. From these data, the U.S. EPA has calculated an average ambient air concentration of 3.4 micrograms per cubic meter ($\mu\text{g}/\text{m}^3$) or 4.1 parts per billion (ppb) and an overall data range of concentrations of 1.0 to 7.5 $\mu\text{g}/\text{m}^3$ (1.2 to 9.1 ppb) (U.S. EPA, 1993a).

INDOOR SOURCES AND CONCENTRATIONS

No information about the indoor sources and concentrations of hydrogen fluoride was found in the readily-available literature.

ATMOSPHERIC PERSISTENCE

Hydrogen fluoride will undergo wet and dry deposition, and will be readily incorporated into cloud, rain, and fog water. The half-life and lifetime will depend on the locality of the release and the occurrence of precipitation events (Atkinson, 1995).

AB 2588 RISK ASSESSMENT INFORMATION

The Office of Environmental Health Hazard Assessment reviews risk assessments submitted under the Air Toxics “Hot Spots” Program (AB 2588). Of the risk assessments reviewed as of December 1996, for non-cancer health effects, hydrogen fluoride contributed to the total hazard index in 13 of the approximately 89 risk assessments reporting a total chronic hazard index greater than 1. Hydrogen fluoride also contributed to the total hazard index in 8 of the

approximately 107 risk assessments reporting a total acute hazard index greater than 1, and presented an individual hazard index greater than 1 in 2 of these risk assessments

(OEHHA, 1996b).

HEALTH EFFECTS

Probable routes of human exposure to hydrogen fluoride are inhalation, ingestion, and dermal contact (U.S. EPA, 1994a).

Non-Cancer: Hydrogen fluoride is severely irritating to the eyes and respiratory tract, and may cause pulmonary edema. Direct contact with solutions may cause severe burns to the eyes and skin. Onset of pain and reddening may be delayed as much as 12 to 16 hours. Low level chronic inhalation exposure of humans has resulted in irritation and congestion of the nose, throat, and bronchi. Chronic exposure to fluoride through drinking water has been observed to cause dental mottling in humans. At higher intakes through oral or inhalation exposure, skeletal fluorosis (an accumulation of fluoride in skeletal tissues associated with pathological bone formation) has been noted in humans (U.S. EPA, 1994a).

An acute non-cancer Reference Exposure Level (REL) of $580 \mu\text{g}/\text{m}^3$, and a chronic REL of $5.9 \mu\text{g}/\text{m}^3$ are listed for hydrogen fluoride in the California Air Pollution Control Officers Association Air Toxics "Hot Spots" Program, Revised 1992 Risk Assessment Guidelines. Toxicological endpoints considered were respiratory irritation for acute exposures, and the respiratory system and skin for chronic exposure (CAPCOA, 1993). The U.S. EPA is currently reviewing the Reference Concentration (RfC) and oral Reference Dose (RfD) for hydrogen fluoride (U.S. EPA, 1994a).

Fluoride has been observed to cross the placenta, and dental fluorosis can occur in a child's teeth when the mother receives high levels of fluoride during pregnancy. Menstrual irregularities have been observed in women occupationally exposed to fluoride; no differences were found in the numbers of pregnancies, miscarriages, or births (U.S. EPA, 1994a).

Cancer: Epidemiological studies have not demonstrated an association between fluoride in drinking water and an increased risk of cancer. Increased rates of cancer have been observed in workers involving possible fluoride exposure; however, these situations involved mixed exposures to several chemicals, and fluoride could not be specifically implicated as the cause of the cancers. The International Agency for Research on Cancer and the U.S. EPA have not classified hydrogen fluoride as to its human carcinogenicity (IARC, 1987a; U.S. EPA, 1994a).

